CLAIMS

What is claimed is:

1. A process for increasing the relative viscosity (RV) of a reactant polyamide, comprising:

contacting the reactant polyamide and a chain extender compound selected from the group consisting of bis-N-acyl bislactam compounds and mixtures thereof, both in a liquid phase, the reactant polyamide having a starting RV, a concentration of amine end groups (AEG(R)), and a concentration of carboxyl end groups (CEG(R)) with the AEG(R) being greater than the CEG(R), the chain extender compound having a concentration of lactam end groups (LEG) of at least about 10 equivalents per million grams of the reactant polyamide less than the AEG(R), for a duration of about 0.5 minutes to about 10 minutes, increasing the RV of the reactant polyamide;

forming a product, other than flake; and

quenching the product to room temperature such that the product has a final RV greater than the starting RV and a concentration of amine end groups (AEG(P)) as defined by the formula:

$$AEG(P) = \{AEG(R) - LEG\} \pm X$$

wherein:

AEG(P) is the concentration of amine end groups in the quenched product in units of equivalents/1,000,000 gms of the product;

AEG(R) is the concentration of amine end groups in the reactant polyamide in units of equivalents/1,000,000 gms of the reactant polyamide;

LEG is the concentration of lactam end groups in the chain extender compound in units of equivalents/1,000,000 gms of the reactant polyamide; and

X is any number in a range of about 0 to about 5.

2. The process of Claim 1, wherein X is any number in a range of about 0 to about 2.

3. The process of Claim 1, wherein the chain extender compound is selected from the group consisting of bis-N-acyl bis-caprolactam compounds and mixtures thereof.

4. The process of Claim 1, wherein the chain extender compound is selected from the group consisting of isophthaloyl bis-caprolactam (IBC), adipoyl bis-caprolactam (ABC), terphthaloyl bis-caprolactam (TBC), and mixtures thereof.

5. The process of Claim 1, wherein the polyamide is selected from the group consisting of poly(hexamethylene adipamide) homopolymer, poly(e-caproamide) homopolymer, polydodecanolactam homopolymer, poly(tetramethyleneadipamide) homopolymer, poly(hexamethylene sebacamide) homopolymer, the polyamide of n-dodecanedioic acid and hexamethylenediamine homopolymer, the polyamide of dodecamethylenediamine and n-dodecanedioic acid homopolymer, copolymers thereof, and mixtures thereof.

6. The process of Claim 1, wherein the forming step comprises spinning the polyamide to form the product which is at least one filament.

7. A product made by the process of:

contacting reactant polyamide and a chain extender compound selected from the group consisting of bis-N-acyl bislactam compounds and mixtures thereof, both in a liquid phase, the reactant polyamide having a starting RV, a concentration of amine end groups (AEG(R)), and a concentration of carboxyl end groups (CEG(R)) with the AEG(R) being greater than the CEG(R), the chain extender compound having a concentration of lactam end groups (LEG) of at least about 10 equivalents per million grams of the reactant polyamide less than the AEG(R), for a duration of about 0.5 minutes to about 10 minutes, increasing the RV of the reactant polyamide;

forming the product, other than flake; and

quenching the product to room temperature such that the product has a final RV greater than the starting RV and a concentration of amine end groups (AEG(P)) as defined by the formula:

$$AEG(P) = \{AEG(R) - LEG\} \pm X$$

wherein:

AEG(P) is the concentration of amine end groups in the quenched product in units of equivalents/1,000,000 gms of the product;

AEG(R) is the concentration of amine end groups in the reactant polyamide in units of equivalents/1,000,000 gms of the reactant polyamide;

LEG is the concentration of lactam end groups in the chain extender compound in units of equivalents/1,000,000 gms of the reactant polyamide; and

X is any number in a range of about 0 to about 5.

8. A filament, comprising:

a synthetic melt spun polymer including:

polyamide repeating units (R_1);

polyamide chain extender moieties (R_2), each independently, selected from the group consisting of bis-N-acyl bislactam moieties; and

terminal groups (R_3), each independently, selected from the group consisting of a hydrogen atom and a hydroxyl group;

the polymer including chains, each independently, having a chemical structure:

$$R_3\text{-}(R_1\text{-}R_2)_y\text{-}R_1\text{-}R_3$$

wherein y is an integer of 1-7; and

the filament has a formic acid relative viscosity of at least about 30.

9. The filament of Claim 8, wherein R_1, each independently, is selected from the group consisting of

(i) $\text{-}\{CO(CH_2)_k\text{-}CONH\text{-}(CH_2)_mNH\}_n\text{-}$, where k and m, each independently, is an integer of 1-12, and n is an integer of 10-140, and

(ii) $\text{-}\{NH(CH_2)_x\text{-}CO\}_z\text{-}$ where x is an integer of 1-12 and z is an integer of 20-280.

10. The filament of Claim 8, wherein R_2, each independently, is selected from the group consisting of bis-N-acyl bis-caprolactam moieties.

11. The filament of Claim 8, wherein R_2, each independently, is selected from the group consisting of an isophthaloyl bis-caprolactam (IBC) moiety, an adipoyl bis-caprolactam (ABC) moiety, and a terphthaloyl bis-caprolactam (TBC) moiety.